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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/007,322	11/09/2001	Shubha Kadambe	HRL073	5870
28848	7590	06/24/2005	EXAMINER	
TOPE-MCKAY & ASSOCIATES 23852 PACIFIC COAST HIGHWAY #311 MALIBU, CA 90265			ALBERTALLI, BRIAN LOUIS	
		ART UNIT	PAPER NUMBER	
		2655		

DATE MAILED: 06/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/007,322	KADAMBE, SHUBHA	
	Examiner	Art Unit	
	Brian L Albertalli	2655	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 25 February 2005.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-3,5,7-14,16,18-25,27 and 29-45 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1,2,12,13,23,24,34,36,38,40,42 and 44 is/are rejected.

7) Claim(s) 3,5,7-11,14,16,18-22,25,27,29-33,35,37,39,41,43 and 45 is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:

- Certified copies of the priority documents have been received.
- Certified copies of the priority documents have been received in Application No. _____.
- Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) <input type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date. _____.
3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.	5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)
	6) <input type="checkbox"/> Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendments to the claims have been entered. Claims 4, 6, 15, 17, 26, and 28 are currently canceled.

Response to Arguments

2. Applicant's arguments filed February 25, 2005 with respect to claims 1, 12, 23, 34, 36, 38, 40, 42, and 44 have been fully considered but they are not persuasive.

Regarding claims 1, 12, and 23, in response to the argument that Bofill et al. do not disclose "means for jointly optimizing" (page 27, last paragraph), the Examiner notes that the limitation requires that the "means for jointly optimizing" is performed iteratively based on an initial estimate of the mixing matrix A (see vi and viii of claim 1).

Equivalently, Bofill et al. teach that a mixing matrix A is assumed to be given (page 88, 1st column, section 2, second paragraph), and the source matrix S is found (the solution of equation 6), using the current estimate of A (page 88, 1st column, paragraph containing equation 7).

In response to the argument that there "is not hint as to generating 'an optimized source signal matrix' and 'a final estimated mixing matrix'" (page 27, last line to page 28 2nd line), the result of solving equation 1 inherently produces "an optimized source signal matrix" and "a final estimated mixing matrix". This is equivalent to the claimed providing means for storing data in a source signal matrix S (see iv of claim 1) and

providing an estimated mixing matrix A where the matrices are related by $X = AS + V$ (see v of claim 1), then solving the equation $X = AS + V$ to determine an optimized source signal S and a final mixing matrix A (see vi through ix of claim 1). The goal of Bofill et al. is to solve equation 1, to determine the matrix of underlying source signals S and the mixing matrix A (page 87, 1st column, last line, to 2nd column, line following equation 1). The solution to equation 1 using the algorithms described in the rest of the paper is the matrix of underlying source signals S and the mixing matrix A, and these solutions are equivalent to “an optimized source signal matrix” and “a final estimated mixing matrix” respectively.

Finally, regarding transforming the mixing matrix (page 28, 3rd paragraph) the Examiner notes that the section of Bofill et al. presented in the Applicant's arguments (apparently the second paragraph of section 3) was not used in the previous rejection. Rather, lines 6-11 of the 1st paragraph of section 3 teach that “when the data is not sparse enough, a useful approach is to use a reversible linear transform of the mixtures into a domain with improved sparsity, realize the separation in that domain, and transform the recovered sources back to the original domain” (emphasis added). This is clearly equivalent to “means for restoring the separated source signals”, as claimed.

Regarding claims 34, 36, 38, 40, 42, and 44, in response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or

motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Sahlin et al. teach that the CR bound provides a benchmark with which to compare other algorithms (page 1, 2nd column, lines 8-10). This holds true whether the number of sources is known or not. It would be advantageous to be able to objectively compare the algorithms disclosed by Bofill et al. using a standard benchmark, such as the CRLB disclosed by Sahlin et al., in order to determine if the algorithms disclosed by Bofill et al. were the most efficient for the given task.

3. Applicant's arguments, see page 30, filed Feb. 25, 2005, with respect to claims 3, 5, 14, 16, 25, and 27 have been fully considered and are persuasive. The rejections of claims 3, 5, 14, 16, 25, and 27 have been withdrawn.

Specification

4. The amendments to the specification overcome the objections made in the previous Office Action. The objections to the specification are withdrawn.

Claim Rejections - 35 USC § 112

5. The rejections of claims 35, 37, 39, 41, 43, and 45 under 35 U.S.C. 112, second paragraph, are withdrawn in light of the Applicant's response (pages 26-27).

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1-2, 12-13, and 23-24 are rejected under 35 U.S.C. 102(e) as being anticipated by Bofill et al. (*Blind Separation of More Sources Than Mixtures Using Sparsity of Their Short-Time Fourier Transform*).

In regard to claims 1, 12, and 23, Bofill et al. discloses an apparatus (computer) and a method for blind separation of an overcomplete (underdetermined) set of mixed signals, the apparatus comprising:

i. a data processing system including an input for receiving mixed signals from a plurality of sensors (M sensors, page 87, 1st column, section 1, line 2) configured to receive mixed signal samples comprising a mixture of signals transmitted from signal sources through an environment and noise (page 88, 1st column, lines 6-7), a signal processor attached with the input for receiving the mixed signals from the sensors, and a memory for storing data during operations of the signal processor (a computer inherently includes a processor and a memory); the data processing system further comprising:

- ii. means for storing data (computer storage device) representing the input from the sensors in a mixed signal matrix X (page 87, 1st column, section 1, lines 1-6);
- iii. means for storing data (computer storage device) representing the noise in a noise matrix V (page 88, 1st column, lines 5-9);
- iv. means for storing data (computer storage device) representing an estimate of the individual signals from the mixture of signals from the signal sources in a source signal estimate matrix S (page 87, 1st column, section 1, line 6 through column 2, line 1);
- v. means for storing data representing an estimate of the effects of the environment in a estimated mixing matrix A where the matrices are related by $X=AS+V$ (page 87, second column, line 1 and page 88, first column line 7);
- vi. means for generating an initial estimate of the estimated mixing matrix A (assume mixing matrix A is given, page 88, 1st column, section 2, 2nd paragraph, line 1 and 5th paragraph, lines 1-3);
- vii. means for determining the number of signal sources and associated lines of correlation of each of the signal sources from the estimated mixing matrix A, and for representing the signal sources in the source signal estimate matrix S (number of sources is estimated, page 89, first column, 3rd paragraph, lines 5-8);
- viii. means for jointly optimizing the source signal estimate matrix and the estimated mixing matrix in an iterative manner, to generate an optimized source signal estimate matrix and a final estimated mixing matrix (page 88, 1st column, equation 7, at each iteration, S is solved for the current estimate of A, lines 1-2 after equation 7); and

ix. means for restoring the separated source signals from the optimized source signal estimate matrix , whereby a plurality of mixed signals from unknown sources traveling through an environment with added noise may be separated so that the original, separate signals may be reconstructed (a matrix S is found, representing the underlying source signals, page 87, 1st column, section 1, line 6; which is transformed to the original domain after separation in the sparse domain, page 88, 2nd column, section 3, lines 6-11).

In regard to claims 2, 13, and 24, Bofill et al. discloses the means for generating an initial estimate of the estimated mixing matrix comprises:

- i. means for transforming the mixed signal matrix X into the sparse domain using a transform operator (page 88, second column, section 3, lines 6-11);
- ii. means for determining a frequency band within the sparse domain that contains the most information that can be used to determine lines of correlation to determine the number of signal sources (local maxima estimate the number of sources, page 89, first column, 3rd paragraph, lines 5-8);
- iii. means for determining a measure (angle) and an optimal threshold (angular resolution) for the measure for the determination of noise within the frequency band (the angular resolution parameter adjusts the resolution of the local contributions, page 89, 1st column, lines 2-4 and 3rd paragraph, lines 1-2); and

iv. means for recalculating the measure used in the determination of the noise within the frequency band using the optimal threshold (the potential function, equation 9, is a recalculation of the angle based on the angular resolution parameter).

v. means for determining the local maxima of a distribution of the measure, where the local maxima represent angles (directions) which are inserted into the estimated mixing matrix to provide an initial estimate of the estimated mixing matrix (page 89, 1st column, third paragraph, lines 2-5).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 34, 36, 38, 40, 42, and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bofill et al., in view of Sahlin et al. (*The Asymptotic Cramer-Rao Lower Bound for Blind Signal Separation*).

In regard to claims 34, 36, 38, 40, 42, and 44, Bofill et al. discloses an apparatus and a method for estimating a mixing matrix A and a source matrix S, the apparatus comprising a data processing system (computer) including a processor, a memory coupled to the processor (a computer inherently includes a processor and a memory,

and an input coupled with the processor (microphone, page 91, 1st column, 2nd paragraph, lines 1-6). Bofill et al. further discloses that the output was listened to; therefore output (speakers or headphones) must be coupled with the processor (page 91, 2nd column, lines 13-15).

Bofill et al. does not disclose determining a CR bound for an estimated mixing matrix A, or for an estimated mixing matrix S.

Sahlin et al. discloses that a lower bound for a matrix of parameter estimates is given by the Cramer-Rao Lower Bound (page 1, 1st column, section 1, line 9 through second column, line 1).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Bofill et al. to determine a CR bound for an estimated mixing matrix A and an estimated source matrix X, in order to provide a benchmark to compare other algorithms, as taught by Sahlin et al. (page 1, 2nd column, lines 8-10).

Allowable Subject Matter

10. Claims 3, 5, 7-11, 14, 16, 18-22, 25, 27, and 29-33, 35, 37, 39, 41, 43, and 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Dependent claims 3, 14, and 25 refer to an apparatus, method and computer program product for blind separation of an overcomplete set of mixed signals, respectively. The prior art of record does not disclose, nor would it suggest to one of ordinary skill in the art, the limitation of adjusting the clustering of the mixed signal samples and parameters of the geometric constraint.

Dependent claims 5, 16, and 27 refer to an apparatus, method and computer program product for blind separation of an overcomplete set of mixed signals, respectively. The examiner agrees that it would not have been obvious to one of ordinary skill in the art to modify Bofill et al. to jointly optimize the matrixes S and A in the presence of noise, as there is no indication as to how to find a solution for the case in which noise is present in Bofill et al.

Dependent claims 7, 18, and 29 refer to an apparatus, method and computer program product for blind separation of an overcomplete set of mixed signals, respectively. The prior art of record does not disclose, nor would it suggest to one of ordinary skill in the art in the recited combination, the step of determining an optimal threshold for generating an initial estimate of a mixing matrix A by computing the entropy $E(\text{ang}, \text{ANG})$ vs. ANG ; and searching for the optimal value of ANG corresponding to the minimum rate of descent of the entropy $E(\text{ang}, \text{ANG})$

Claims 8-11, 19-22, and 30-33 would then be allowable because they further limit claims 7, 18, and 29.

Dependent claims 35, 37, 39, 41, 43, and 45 refer to apparatus, method and computer program product for the determination of a CR bound for both an estimated mixing matrix A and a estimated signal matrix S. The prior art of record does not disclose, nor would it suggest to one of ordinary skill in the art in the recited combination, a parameter λ_k^2 which is developed from a log likelihood function depending on a representation of the source signal S.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L Albertalli whose telephone number is (571) 272-

7616. The examiner can normally be reached on Mon - Fri, 8:00 AM - 5:30 PM, every second Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wayne Young can be reached on (571) 272-7582. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BLA 6/20/05


SUSAN MCFADDEN
PRIMARY EXAMINER